Appl. No. 10/650,272
Amdt. dated April 20, 2007
Reply to Office Action of 11/21/2006

PATENT
Docket: 020306

IN THE SPECIFICATION

Please replace the following paragraphs in the Specification with the following rewritten paragraphs:

[0002]   Application Serial No. 10/650,271 ~~/ , ~~, entitled "METHOD AND APPARATUS FOR REMOVING CODE ALIASES WHEN USING SHORT SYNCHRONIZATION CODES," filed on same date herewith, by Haitao Zhang~~, attorney's docket number 020305~~.

[0027]   Such systems also use the received signal to estimate the ~~input~~ impulse response of the communication channel 108. This information is used to improve later detection and reception of signals from the transmitter 110. In circumstances where the spreading sequence S_i 104 is relatively short, the data packet 128 must be detected quickly, and there is less data available to estimate the response of the communication channel 108.

[0060]   In one embodiment of the present invention, supercodes, such as Walsh-like supercodes, are used to drastically reduce the amount of the integration required. This technique is especially useful in systems having sufficient ~~a~~ signal-to-noise ratio (SNR).

[0061]   Any ~~length~~ 2-symbol length segment from this sequence can be described as either w_0 or $-w_0$, except for a single w_1 in the center. If this sequence is now correlated with w_1, the resulting correlation will be characterized by a single peak in the center and zeros elsewhere (except near the boundaries). Negatives of the two codes may be taken (e.g. $w_0 = \{-1,-1\}$ and $w_1 = \{-1,+1\}$) and/or their roles may be swapped (e.g. $w_1 = \{+1,+1\}$ and $w_0 = \{+1,-1\}$) with the same result. The three additional patterns thus obtained and their correlator patterns are listed below:

[0070]   The constrained portion Cd_i 602 is associated with at least two codes, w_0 and w_1. The codes w_0 and w_1 are selected such that the correlation $A_{code}(k)$ of the constrained portion

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Cd_i 602 and at least one of the codes w_0 and w_1, is characterized by a maximum value at

$k = 0$, and ~~they~~ value less than the maximum value at $k \neq 0$.

[0071] Ideally, the correlation $A_{code}(k)$ of the constrained portion Cd_i 602 is an impulse,

with $A_{code}(k)$ equal to one at $k = 0$, and equal <u>to zero</u> at all other values for k. However,

because such correlation characteristics are typically not realizable, codes w_0 and w_1 can be

chosen to approximate this ideal. For example, codes w_0 and w_1 can be chosen such that the

correlation $A_{code}(k)$ of the constrained portion Cd_i 602 and at least one of the codes w_0 and

w_1, is such that $A_{code}(k) = 1$ at $k = 0$ and $A_{code}(k) \approx 0$ for substantially all $k \neq 0$. Or, codes

w_0 and w_1 can be chosen such that the correlation $A_{code}(k)$ of the constrained portion Cd_i

602 and at least one of the codes w_0 and w_1, is such that $A_{code}(k) = 0$ for $0 < |k| \leq J$,

wherein J is selected to minimize the correlation of the constrained portion Cd_i with the one

of the codes w_0, w_1 for substantially all $k \neq 0$.

[0077] In one embodiment, the codes w_0 and w_1 are two symbol-long Walsh codes,

and $\hat{h}_M(t)$ <u>is</u> computed as $\dfrac{1}{M}\displaystyle\sum_{m=0}^{M-1} d_m \bullet co(t + mNT_c)$, with $M = 2$. In this case, $\hat{h}_M(t)$ equals

$$\hat{h}_2(t) = \frac{1}{2}\left(d_0 \bullet co(t) + d_1 \bullet co(t + NT_c)\right).$$

[0090] The foregoing has demonstrated that distortions due to this spreading sequence

design can be removed from the estimate of the communications channel impulse response.

Attention is now turned to the remaining distortion caused by the additive <u>noise</u> ~~noise.~~ $n(t)$

121. Assuming that the noise source is white and stationary and is filtered by a receiver filter

for bandwidth matching, its distortion measure can be defined as follows:

[0093] FIG. 7 through FIG. 10 are diagrams illustrating the performance improvements

achieved by application of the present invention. These illustrated examples <u>are for a case</u>

~~and places them,~~ whereby a length 11 Barker code is used as the spreading sequence S_i 104.

FIGs. 7-10, show normalized magnitudes as a function of chip timing. No adjustments were made for group delays introduced by correlation, filtering and windowing, therefore time coordinates should be treated in the relative sense. FIGs. 7-10 also do not include the effects of additive noise.

[0094]   FIG. 7 is a diagram presenting a correlator 116 output using a length 11 Barker code and conventional communication channel impulse response estimation techniques. The correlator 116 output shows to a main lobe peak 702, and multiple spurious peaks 704. These spurious peaks 704 (which are 11 chips, or NT_c seconds, apart due to the length 11 Barker code) are due to the repeated transmission of the short code S_i 104, which are "aliased" back upon each other. If the length of the periodic spreading sequence S_i 104 were longer, there would be fewer spurious peaks 704, and the peaks 704 would not overlap the main lobe peak 702 as much as is shown in FIG. 7.